Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Longyou 18 MW Hydropower Project in Zhejiang Province
Version number of the PDD	08 (updated addressing to renewal of crediting period)
Completion date of the PDD	16/03/2016
Project participant(s)	The project owner: Zhejiang Longyou Xiaoxitan Hydro Complex Development Co., Ltd. The buyer: China Carbon N.V.
Host Party	P.R.China
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Scope 1, Energy industries (renewable - / non- renewable sources) Applied methodology: ACM0002. "Grid-connected electricity generation from renewable sources(Version 16.0)
Estimated amount of annual average GHG emission reductions	56,474 tCO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Longyou 18 MW Hydropower Project in Zhejiang Province (hereafter referred to as the Project) developed by Zhejiang Longyou Xiaoxitan Hydro Complex Development Co., Ltd. is sited on the Qujiang river, 6.5 km downstream from the convergence of the Qujiang river and the Lingshangang river in Longyou County, Zhejiang Province.The primary purpose of the Project is to utilize the water resources of the Qujiang river to generate clean electricity to deliver to the East China Power Grid (ECPG) through the Zhejiang Power Grid (ZJPG) without CO_2 emissions. Furthermore, the Project can promote the capability of shipping, water supply and irrigation for local area.

The Project is a newly-built hydropower project with the total installed capacity of 18 MW. The flooded land area resulting from the Project is 644,773.6 m^2, and the power density is 27.9 W/m^2. It is estimated that the electricity supplied to the grid will be 78.77 GWh annually. The Project activity will achieve greenhouse gas (GHG) emission reductions by avoiding CO_2 emission from the business-as-usual scenario, electricity generated by those fossil fuel-fired power plants connected into ECPG. The estimated emission reductions are 56,474 tCO_2e per year.

As a renewable energy project, the Project will produce positive environmental and socio-economic benefits and contribute to the local sustainable development through following aspects:

- Contributing to local economy development by providing electricity to meet local increasing energy demands;
- Reducing GHG emissions compared to a business-as-usual scenario;
- Reducing the emission of other pollutants resulting from local coal-based power plants, compared to a business-as-usual scenario;
- Creating 50 permanent jobs and lots of short-term employment opportunities for local people during the project construction and operation period.

A.2. Location of project activity

A.2.1. Host Party

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People’s Republic of China.

A.2.2. Region/State/Province etc.

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Zhejiang Province.

A.2.3. City/Town/Community etc.

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Huzhen Town, Longyou County, Quzhou city.

A.2.4. Physical/Geographical location

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The Project is sited within Huzhen Town, Longyou County, Quzhou City, Zhejiang Province, P.R.China. The Project’s dam site is located 500 m upstream from Xiaoxitan Village, Huzhen Town, about 7 km from Longyou County and about 41 km from Quzhou City. The geographical coordinates of the Project site are 29°4′ N-119°15′ E in degrees. Figure 1 and Figure 2 show the detailed geographical location of the Project site.

Figure1. Location of Zhejiang Province in China

Figure 2. Location of the Project

A.3. Technologies and/or measures

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The Project is a riverbed-type hydropower plant with low hydraulic head and big discharge flow. The rubber dams and the powerhouse houses drive up the water to form the hydraulic head, and then the water flows into the powerhouse and drives the hydraulic generators to produce electricity.

The Project includes a reservoir, rubber dams, drainage pump rooms, a powerhouse houses, a booster station, a sand-flushing sluice, a ship lock and a 35 KV transmission line to substation. The reservoir is of 12.50 million m^3 storage capacity, and the maximal dam height is 4.5 m.

The Project will install four turbines with a unit capacity of 4.5 MW. Key technical parameters of the hydro turbine and the generator are listed in Table 1.

Table 1. Key technical parameters of the hydro turbine and the generator

Hydro Turbine		Generator	
Turbine Type	GZ1250a-WP-420	Generator Type	SFWG4500-60/4700
Rated head	4.65m	Rated Capacity	4500 kW/5000 kW
Rated power	4500 kW	Rated voltage	6300 V
Rated flow	112.17 m^3/s	Rated current	458.2 A
Rated speed	93.8r/min	Rated power factor	0.9
Runaway speed	960r/min	Rated speed	93.8 r/min
Declared working condition efficiency	92.09%	Rated efficiency	95.5%
Best efficiency	95.49%	Flywheel moment GD	340 t·m2
Installation draught-height	-5.7 m		

With all technologies and facilities provided domestically, the Project involves no technology transfer from abroad.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host)	Zhejiang Longyou Xiaoxitan Hydro Complex Development Co., Ltd. (project owner)	No
Netherlands	China Carbon N.V. (purchasing company)	No

A.5. Public funding of project activity

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There is no public funding from Appendix I Parties for the Project.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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The approved baseline and monitoring methodology ACM0002 Version 16.0.

http://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83

"Tool to calculate the emission factor for an electricity system" (Version 05.0.0)

http://cdm.unfccc.int/methodologies/PAmethodologies/approved

Other tools: "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 3.0.1)

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf/history_view

B.2. Applicability of methodology and standardized baseline

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The Project is a newly-built grid-connected renewable power generation project activity, and meets the applicable criteria of the methodology ACM0002 (Version 16.0) due to following reasons:

- The Project is a new hydropower plant with a new reservoir having power density of 27.9 W/m^2, which is greater than 4 W/m^2, constructed and operated at a site where no renewable energy power plant was operated prior to the implementation of the project activity;
- The Project is not a activity that involves switching from fossil fuels to renewable energy at the site of the Project activity; and
- The geographic and system boundaries for ECPG that the Project is connected into can be clearly identified and information on the characteristics of the Grid is available.

Therefore the methodology ACM0002 (Version 16.0) is chosen and applicable to the Project.

B.3. Project boundary

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The electricity generated by the Project will be transferred to ECPG, therefore ECPG is defined as the project boundary of the Project. According to *Notification on Determining Baseline Emission Factors of China Power Grid*[1] issued by the National Development and Reform Commission of the Government of China (China DNA), ECPG is composed of five provincial power grid: Zhejiang Power Grid, Jiangsu Power Grid, Shanghai Power, Fujian Power Grid and Anhui Power Grid.

The spatial scope of the project boundary covers the Project site and all power plants connected physically into ECPG.

[1] China DNA (http://cdm.ccchina.gov.cn), December 15th ,2006.

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the Project activity.	CO_2	Yes	Main emission resource.
		CH_4	No	Minor emission resource.
		N_2O	No	Minor emission resource.
Project scenario	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission resource.
		CH_4	Yes	The power density is 27.9W/m^2 which is greater than 10W/m^2, so the project emission is 0.
		N_2O	No	Minor emission resource.

B.4. Establishment and description of baseline scenario

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For the second crediting period, the continued validity of the original baseline should be assessed. According to the tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)”, the stepwise procedure as follows should be adopted:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

In China, the Renewable Energy Law has been put into effect since 2006, which encourages the development of renewable energy projects. However, although renewable energy projects have been developed rapidly in recently years, grid connected power generation in China is still dominated by fossil-fuel power plants. There are no new relevant national and/or sectoral policies and/or circumstances in the electricity generation sector applicable to the project activity, in comparison to the time of the submission of the project activity for validation, which would affect the compliance of the current baseline scenario.

Step 1.2: Assess the impact of circumstances

There are no new relevant national and/or sectoral policies and/or circumstances in the electricity sector applicable to the Project Activity, in comparison to the time of the submission of the project activity for validation, which could impact the validity of the current baseline for the next crediting period. Therefore, the current baseline scenario does not need to be updated for the second crediting period. The project activity applies ACM0002 methodology which clearly defines that for new grid-connected renewable power plant/unit, as it is the case, the baseline scenario is: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

The project activity consists of the implementation of wind power plant where no electricity was generated prior to its implementation. In the absence of the CDM project activity, the project owner would not have constructed the plant and electricity would have been generated by other power plants connected to the grid. Therefore, this sub-step is not applicable since the identified baseline scenario at the validation of the project activity did not correspond to the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties)

would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

Step 1.4: Assessment of the validity of the data and parameters

According to the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of a crediting period", updates should be undertaken in the following cases:

- Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC;
- Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.

The values of W_{OM} and W_{BM} are revised at the renewal of the crediting period, the values used for the calculation of $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are updated in the second crediting period.

Application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline is valid for the second crediting period but data and parameters needs to be updated. Therefore step 2 is used.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The baseline emissions for the second crediting period has been updated, without reassessing the baseline scenario, based on the latest approved version of the methodology ACM0002. This update was applied in the context of the sectoral policies and circumstances that is applicable at the time of requesting for renewal of the crediting period. More details for the updated baseline emissions for the second crediting period can be seen in section B.6.

Step 2.2: Update the data and parameters

Considering the changes on circumstances related to calculation of CO_2 emission factor, the baseline emissions were reviewed in this second crediting period following the latest version of the "Tool to calculate the emission factor for an electricity system". See sections B.6.1, B.6.2 and B.6.3 of this PDD.

B.5. Demonstration of additionality

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Not applicable for the 2nd crediting period.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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The methodology ACM0002 (version 16) is applicable to the Project.

Baseline emissions calculation

Step 1. Identify the relevant electricity systems

In accordance with the boundary definitions of the Chinese DNA, The spatial extent of the project boundary includes the Project and all power plants connected physically to the ECPG that the Project is connected to. ECPG is defined as the project electricity system, which consists of independent province-level electricity systems including Shanghai city, Jiangsu province, Zhejiang province, Anhui province and Fujian province. That can be dispatched without significant

transmission constraints. For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system (ECPG).

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

The following two options can be chosen to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

For the Project, method **I** is adopted.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$ *) is based on one of the following methods: which are described under Step 4:*

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

The application of method (c) requires availability of dispatch data. However, the detailed data of dispatch are taken as confidential business information by the grid company and not publicly available. Thus, method (c) cannot be adopted for the Project. Similarly, the data of annual load duration curve required by method (b) also cannot be obtained publicly. Therefore, method (b) is also not applicable here.

Among the total electricity generations of the ECPG, from 2008-2012, the amount of low-cost/must run resources all less than 50%. It cannot fulfil the requirement of method (d), but fulfils the requirement of method (a). Thus, the method (a) can be used to calculate the operating margin emission factor. For simple OM, the emission factor can be calculated using either of the two following data vintages:

- Ex ante option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation, or
- Ex post option: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of the year y, the emission factor of the year preceding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

For the Project, ex-ante option is adopted for calculation of the OM emission factor ($EF_{grid,OM,y}$) of ECPG.

Step 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated by one of the following two options:

Option A: Based on data on fuel consumption and net electricity generation of each power unit, or

Option B: Based on data on total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.
Since the data on fuel consumption and net electricity generation of each power plant / unit is not publicly available. Thus, Option A cannot be adopted for the Project.

According to the 2014 Baseline Emission Factors for Regional Power Grids in China, only nuclear and renewable power generations are considered as low-cost / must-run power sources. And the quantity of electricity supplied to the grid by low-cost / must-run power sources is known. Therefore, Option B is adopted to calculate the simple OM emission factor of ECPG.

The simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{co_2,i,y} \right)}{EG_y} \quad (2)$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fuel type i in year y (GJ / mass or volume unit)
$EF_{co_2,i,y}$	CO_2 emission factor of fuel type i in year y ($kgCO_2$/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	All fuel types combusted in power sources in the project electricity system in year y
y	The three most recent years

For this approach (simple OM) to calculate the operating margin, the subscript m refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid. Electricity imports should be treated as one power plant m.

As discussed in step 1, emission factor for the net electricity imports (EF_{grid},$OM_{simple,y}$) is determined in the same way as the simple OM emission rate of the exporting grid.

Given the above, the simple operating margin CO2 emission factor (EF_{grid},$OM_{simple,y}$) of ECPG is 0.8095tCO2/MWh. The detailed calculations and data are listed in the Appendix 4.

Step 5. Calculate the build margin (BM) emission factor

The sample group of power units *m* used to calculate the build margin consists of either:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEG_{SET}-5-units, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power

units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEG_{SET}-≥20%, in MWh);

(c) From $SET_{5-units}$ and SET≥20% select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Since the set of power units described as (b) in ECPG comprises the larger annual generation than that of (a), the sample group (b) should be used for calculating the build margin of ECPG. The power plant projects that have been registered as CDM project activities should be excluded from the sample group m.

In terms of vintage of data, project participants chooses Option 1 to calculate the BM emission factor ($EF_{grid,BM,y}$) of ECPG. Option 1 as follow:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (3)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh).
m	Power units included in the build margin
y	Most recent historical year for which electricity generation data is available

Currently in China, the capacity margin data of sampling plants group m are publicly unavailable. Taking notice of this situation, CDM EB accepts the following deviation in application of methodology ACM0002 (Version 16) in China[2]:

✧ Use of capacity additions exceeds 20% of total generation for estimating the build margin emission factor for grid electricity.

[2] http://cdm.unfccc.int/Projects/deviations

- ✧ Use of weights estimated using installed capacity in place of annual electricity generation.
- ✧ Use the efficiency level of the best technology commercially available in the provincial/regional or national grid, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

It is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

For the Project: Firstly, calculate the share of different power generation technology in recent capacity additions. Secondly, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor using the efficiency level of the best technology commercially available in China.

Due to the installed capacities of coal based, oil based and gas based cannot be separated and determined directly at present, BM is calculated with following steps and formula:

***Sub-Step 5.1*. *With the energy balance sheet in China Energy Statistical Yearbook for the most recent year, calculating the respective percentage of CO_2 emissions from coal fired power generation, oil fired power generation , and gas fired power generation against total CO_2 emissions from fuel fired power generation*:**

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{i,j} \times EF_{co2,i,j}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j} \times EF_{co2,i,j}} \quad (4)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{i,j} \times EF_{co2,i,j}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j} \times EF_{co2,i,j}} \quad (5)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{i,j} \times EF_{co2,i,j}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j} \times EF_{co2,i,j}} \quad (6)$$

Where:

$F_{i,j,y}$	is the amount of fuel i (in a mass or volume unit) consumed by province j in year(s) y
$NCV_{i,j}$	Net calorific value (energy content) of fuel type i consumed by province j (GJ / mass or volume unit).
$EF_{co2.i.j}$	CO_2 emission factor of fuel type i consumed by province j (tCO_2/GJ)
Coal、Oil and Gas	are footnote group for solid fuels, liquid fuels and gas fuels.

***Sub-Step 5.2. Calculation of Emission Factor of Relevant Thermal Power*.**

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv_{,y}} + \lambda_{Oil}, y \times EF_{Oil,Adv_{,y}} + \lambda_{Gas,y} \times EF_{Gas,Adv_{,y}} \quad (7)$$

Where:

$EF_{Coal,Adv_{,y}}$, $EF_{Oil,Adv_{,y}}$ and $EF_{Gas,Adv_{,y}}$ are the emission factors of the best technology for coal, oil, gas fired power plants commercially available in China, which are calculated based on the efficiency level of the best technology for each fuel type commercially available in China (see details in Appendix 4).

Sub-Step 5.3*. *Calculation of BM of the Grid

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (8)$$

Where:
$CAP_{Total,y}$ is the additional capacity which is close to but not more than 20% of the existing capacity,
$CAP_{Thermal,y}$ is the additional capacity of thermal plants.

The Project adopts the latest data of OM emission factor in ECPG which is issued by China DNA. Please refer to "*Baseline Emission Factors of China Power Grids in 2014"* by China DNA and Appendix 4 for the concrete calculation process.

The Build Margin emissions factor is now calculated as the percentage of thermal plant additions and thermal plant emissions factor.

Based on the formula above, the BM emission factor of ECPG for the Project in the crediting period is calculated as:

$EF_{grid,BM,y}$ = 0.6861tCO_2e/MWh.

The details of $EF_{grid,BM,y}$ calculation are given in Appendix 4.

Step 6. Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (9)$$

Where:

$EF_{grid,BM,y}$	Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$	Operating margin CO2 emission factor in year y (tCO2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

The weight w_{OM} and the weight w_{BM} are 0.25 and 0.75 for the second crediting period.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$
=0.8095 tCO2/MWh **0.25+0.6861* tCO2/MWh **0.75*
=0.71695 tCO2/MWh

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad (10)$$

Where:
BEy Baseline emissions in year y (t CO2/yr)
$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (t CO_2/MWh)

Project activity emissions

According to the methodology ACM0002 (Version 16), the project emissions have to be considered following the procedure described in the methodology ACM0002 (version 16), which is as follows:

$$PE_y = PE_{FF,y} + PE_{HP,y} + PE_{GP,y} \quad (11)$$

Where:

PE_y	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	Project emissions from fossil fuel consumption in year *y* (tCO_2e/yr)
$PE_{GP,y}$	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)
$PE_{HP,y}$	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

Since the Project is a newly-built hydropower project and there is no fossil fuels consumed, the Project emissions are calculated as:

$PE_y = PE_{HP,y}$ The calculation of $PE_{HP,y}$ depends on the power density of the project activity which should be calculated firstly as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (12)$$

Where:
PD = Power density of the project activity, in W/m^2.
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

The Project is a newly-built diversion hydropower project, the power density is $27.9W/m^2$ which is greater than $10W/m^2$. Therefore, based on the methodology ACM0002, Project emissions from water reservoirs ($PE_{HP,y}$) = 0.

According to information above, the GHG emission of the Project is zero, as PE_y =0 tCO_2.

Leakage

According to the methodology ACM0002 (Version 16), no leakage emissions are considered.

Emission reductions

The emission reductions (ER_y) by the Project activity during a given year y is the difference between baseline emissions (BE_y) and the project activity emissions (PE_y), as follows:

$$ER_y = BE_y - PE_y \quad (13)$$

Where:
ER_y = Emission reductions in year *y* (tCO_2/y)

BE_y = Baseline emissions in year *y* (tCO_2/y)

PE_y = Project emissions in year *y* (tCO_2/y)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	*Electricity generation*
Unit	*MWh*
Description	*The total electricity generation and the electricity generated by those low-cost/must run power plants of ECPG on 2008, 2009, 2010, 2011 and 2012.*
Source of data	*China Electric Power Yearbook 2009, 2010, 2011, 2012 and 2013 Edition.*
Value(s) applied	*Detailed in China Electric Power Yearbook 2009, 2010, 2011, 2012 and 2013 Edition.*
Choice of data or Measurement methods and procedures	*ECPG is defined as the project boundary of the Project.* *According ACM0002, method of simple OM can only be used where low-cost/must run resources constitute less than 50% of total grid generation.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	$GEN_{j,y}$
Unit	*MWh*
Description	*The electricity generation supplied to ECPG on 2010, 2011 and 2012, excluding those generated by low-cost/must run power plants.*
Source of data	*China Electric Power Yearbook 2011, 2012and 2013 Edition.*
Value(s) applied	*Detailed in Appendix 3.*
Choice of data or Measurement methods and procedures	*ECPG is defined as the project boundary of the Project.* *According ACM0002, those low-cost/must-run power plants in ECPG are excluded for calculation of simple OM emission factor.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	*Installed Capacity*
Unit	*MW*
Description	*The installed capacity by different sources of ECPG in 2010, 2011 and 2012.*
Source of data	*China Electric Power Yearbook 2011, 2012 and 2013 Edition.*
Value(s) applied	*Detailed in Appendix 3.*
Choice of data or Measurement methods and procedures	*ECPG is defined as the project boundary of the Project.* *According to the deviation accepted by the CDM EB, the installed capacity is used in place of annual electricity generation for calculation of BM emission factor.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	$F_{i,j,y}$
Unit	*10^4t or 10^8m^3*
Description	*Different fuel consumptions for power generation in ECPG in 2010, 2011 and 2012.*
Source of data	*China Energy Statistical Yearbook (2011-2013) Edition, China Energy Statistical Yearbook 2013.*
Value(s) applied	*Detailed in Appendix 3.*
Choice of data or Measurement methods and procedures	*ECPG is the project boundary of the Project.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	NCV_i
Unit	*GJ/t or GJ/10^3m^3*
Description	*Average low calorific values of fuels for electricity generation.*
Source of data	*China Energy Statistical Yearbook 2013 Edition.*
Value(s) applied	*Detailed in Appendix 3.*
Choice of data or Measurement methods and procedures	*Country-specific values are adopted.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	$EF_{CO2,i}$
Unit	*tC/TJ*
Description	*Emission factors of fuels for electricity generation.*
Source of data	*“2006 IPCC Guidelines for National Greenhouse Gas Inventories” Volume 2.*
Value(s) applied	*Detailed in Appendix 3*
Choice of data or Measurement methods and procedures	*IPCC world-wide default values are adopted.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	$OXID_i$
Unit	
Description	*Oxidation rates of fuels for power generation.*

Source of data	*"2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2.*
Value(s) applied	*Detailed in Appendix 3.*
Choice of data or Measurement methods and procedures	*IPCC world-wide default values are adopted.*
Purpose of data	
Additional comment	*Official data.*

Data / Parameter	*Best efficiency level of thermal power*
Unit	-
Description	*The efficiency level of the best coal-based, oil-based and gas-based power generation technology commercially available in China.*
Source of data	*Notification on Determining Baseline Emission Factors of China Power Grid*
Value(s) applied	*Detailed in Appendix 3*
Choice of data or Measurement methods and procedures	*According to the deviation accepted by CDM EB, the efficiency level of the best technology commercially available in the national grid of China is used as a conservative value for calculation of BM emission factor.*
Purpose of data	
Additional comment	*Official data.*

B.6.3. Ex ante calculation of emission reductions

>>

Baseline emissions calculation

The OM emission factor ($EF_{OM,y}$) of ECPG is calculated as 0.8095 tCO_2e/MWh, and the build margin emission factor ($EF_{BM,y}$) of ECPG is calculated as 0.6861 tCO_2e/MWh. The detailed calculations and data are listed in Appendix 3.

Based on formula (9) in section B.6.1, the baseline emissions factor (EF_y) of ECPG is calculated as 0.71695 tCO_2e/MWh.

Based on *Preliminary Design Report* of the Project, the annual output supplied to the grid (EG_y) is estimated to be 78.77 GWh. So it is estimated that the baseline emissions of the Project will be 56,474 tCO_2e based on formula (10) in section B.6.1.

Project activity emissions calculation

As described in section B.6.1, the Project activity emissions (PE_y) will be 0 tCO_2e.

Leakage

As described in section B.6.1, the leakage of the Project (L_y) is 0 tCO_2e.

Emission reductions calculation

Based on formula (11) in section B.6.1, the ex-ante annual emission reductions are estimated as 56,474 tCO_2e.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
12/08/2016-31/12/2016	21,971	0	0	21,971
01/01/2017-31/12/2017	56,474	0	0	56,474
01/01/2018-31/12/2018	56,474	0	0	56,474
01/01/2019-31/12/2019	56,474	0	0	56,474
01/01/2020-31/12/2020	56,474	0	0	56,474
01/01/2021-31/12/2021	56,474	0	0	56,474
01/01/2022-31/12/2022	56,474	0	0	56,474
01/01/2023-11/08/2023	34,503	0	0	34,503
Total	395,318	0	0	395,318
Total number of crediting years	7			
Annual average over the crediting period	56,474	0	0	56,474

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Measured by meters installed at the Project site.
Measurement procedures (if any)	This parameter should be calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid (EG_{export}); and (b) the quantity of electricity the project plant/unit from the grid (EG_{import}):$EG_{facility,y}=EG_{export} - EG_{import}$ EG_{export} and EG_{import} should be measured monitored using bi-directional energy meter with accuracy not less than 0.5S, which should be annually calibrated.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures	Cross-check measurement results with records for sold electricity
Any comment	

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Measurement procedures (if any)	Determine the installed capacity based on manufacturer's specifications or commissioning data or recognized standards
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-

Any comment	-

Data / Parameter	A_{PJ}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Measurement procedures (if any)	Measured from topographical surveys, maps, satellite pictures, etc.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Any comment	-

B.7.2. Sampling plan

>>
Not applicable.

B.7.3. Other elements of monitoring plan

>>
In this PDD, emission factor of the Project is determined ex-ante. Therefore the electricity generation supplied to the grid by the Project is defined as the key data to be monitored. The monitoring plan is drafted to focus on this data.

1. Implementation of the monitoring plan

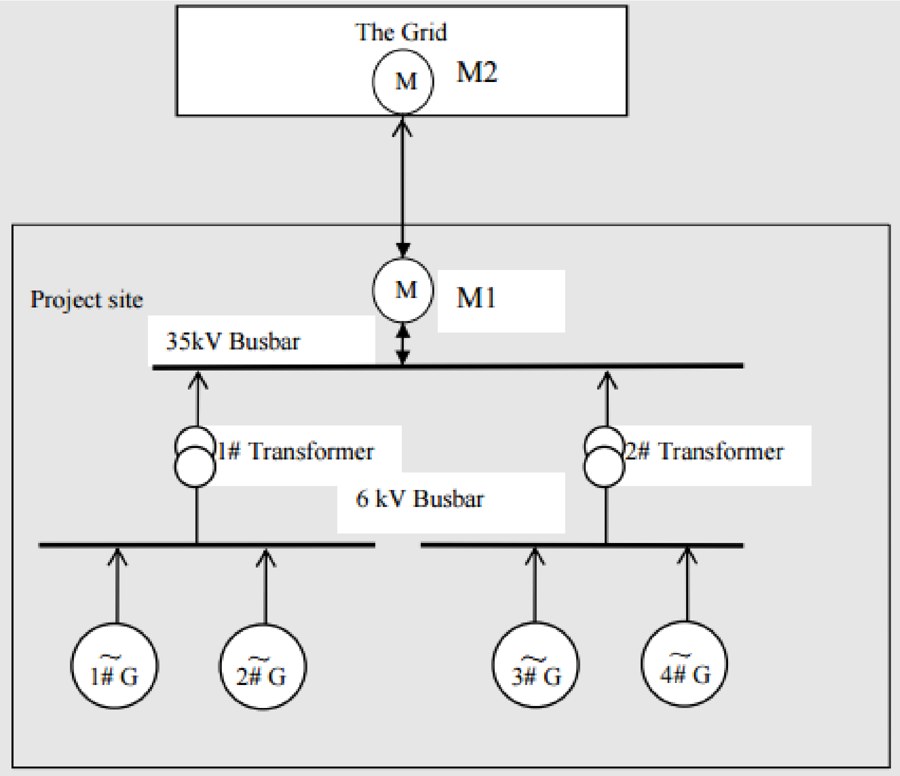
The Project owner, Zhejiang Longyou Xiaoxitan Hydro Complex Development Co., Ltd will take the responsibility of the monitoring plan implementation.

The staff from technology and financial departments will undertake the monitoring tasks including watching metering equipments daily, collecting electricity data and completing records, checking and analyzing the data, archiving relevant records, and reporting to company administrator or supervisor.

The staff concerned will receive training on monitoring and measurement to ensure the implementation of this monitoring plan before project operation. In the following years within the crediting period, the training will also be provided.

2. Monitoring of the electricity supplied to the grid by the Project

The EG_{export} and EG_{import} will be continuously monitored through bi-directional meters installed at the Project site. The line diagram showing meter location is as follows:



On duty staff will watch the operation status of metering equipments everyday on site. Furthermore, designated staff will collect the measured electricity data and complete the corresponding records on a monthly basis. Before being archived, these records will be checked by other staffs to ensure the correctness. The data from these records will be digested and analyzed and the results will be reported to company administrator or supervisor.

All the relevant data records will be kept by the Project owner during the crediting period and two years after for DOE's verification.

3. Quality assurance and quality control

The quality assurance and quality control procedures involves of data monitoring, recording, maintaining and archiving, and monitoring equipment calibration.

The EG_{export} *and* EG_{import} *will be monitored through metering equipment at the Project site. The data should be cross-checked against relevant electricity sales receipts and/or records from the grid for quality control. The Power Purchase Agreement between the Project owner and the grid company can be used as guidance on data collection and documentation.*

Calibration of Meters & Metering should be implemented according to national standards and rules (such as DL/T448-2000 the Technical Management Rules for Electric Power Measuring Installations), and all the records should be documented and maintained by the Project owner for DOE's verification.

4. Emergency procedures for the monitoring system

Problem occurred in monitoring and measurement process will be recorded and reported to company administrator or supervisor. Consequently, the corrective resolution will be adopted to deal with that problem and to avoid it occur again in future.

5. Verification

It is expected that the verification of emission reductions generated from the Project will be done annually.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Hanergy Carbon Asset Management (Beijing) Inc.

10/F Tower B, North Star Century Center, No.8 Beichenxi Rd., Chaoyang District, Beijing China 100101

Contact person: Wang Yingying

Tel +86 10 83914567

Fax +86 10 83914555

The entity is not a project participant.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
30/11/2004.

C.1.2. Expected operational lifetime of project activity

>>
40y-0m.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Renewable

Second crediting period (12/08/2016-11/08/2023)

C.2.2. Start date of crediting period

>>
12/08/2016

C.2.3. Length of crediting period

>>
7 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
Zhejiang Design Institute of Water Conservancy & Hydro-electric Power (ZDWP) was commissioned by the Project owner to conduct the Environmental Impact Assessment (EIA) of the Project. The EIA of the Project has been approved by the Environment Protection Bureau of Zhejiang Province.

According to the EIA and *Preliminary Design Report* of the Project, environmental impacts possibly caused by the Project and protect measures adopted by the project owner are analyzed as follows:

Wastewater and solid waste

Wastewater includes production wastewater and sanitary wastewater. The production wastewater of the Project mainly consists of water produced by pouring, equipment maintenance and flushing, which will be washed downstream after sedimentation process. Thus, there has little influence on the water quality. The sanitary wastewater cannot be drained unless it is disposed in advance to reach the class I of Chinese environmental standard specified as "*Sewage Discharge Standard" (GB8978-1996).*

Solid waste mainly comes form construction waste and domestic garbage, especially the former. The impacts of construction waste can be reduced by orderly dumping, retaining wall and grass-planting virescence. An onsite temporary garbage dump will be set and the domestic garbage will be cleaned up and transported by the sanitary branch.

Air pollution and noise

The Project will generate noise, exhaust gas and dust pollution as a result of construction activities of facilities operating, excavating, landfilling, milling, cement loading and unloading, and increased traffic. As the construction site is far from the inhabitants, e.g. Xiaoxitan Village is 400 m downstream from the dam, Caolong Village is located on the left bank 600 m upstream from the dam, and Qingtianpu Village is located on the right bank 400 m from the jetty head, the impacts of the Project on the inhabitants are considered insignificant. The Project owner will mitigate the impacts on workers from exhaust gas, noise and dust through reasonably arranging the workers' living area, enclosing the construction area and strengthening labour protection measures.

Land use

The Project will result in submergence of parts of Huzhen Town and Lantang Town, Longyou County, and the whole Baidixu Village. Therefore the entire population of Baidixu Village needs to be relocated.

The Project owner has signed the resettlement agreement and the compensation agreement for land occupation with local residents according to relevant national and local regulations.

Ecological impacts

As the runoff of the river varies slightly in a day, the Project will have insignificant impacts on the hydrology and the diversity of plankton type community.

Because there are no valuable and rare wild animal inhabitants and common animals are unfrequent, the Project will have no impacts on terrestrial animals. The construction of the Project will have little influence on the water flow quantity, and as there is no spawning site for fish nearby, the adverse impacts on fishery production are considered insignificant.

The project will submerge some tilth, garden and woodland, but the flooded area is comparative small to the reservoir area and the catchment area, meanwhile no mountain forest will be submerged. Therefore, the impacts on the vegetation of the reservoir and catchment area are considered insignificant

Water and solid loss

Water and solid loss will come along with the construction of the Project because of excavation of earth, construction and solid waste dumping. The *Report of Water and Solid Conservation Plan*

has been approved by the Water Conservancy Bureau of Zhejiang Province, and the Project owner will strictly enforce this plan during the construction period to mitigate the water and solid loss.

D.2. Environmental impact assessment

>>

The Project has no significant impacts on local environment and the EIA of the Project has been approved by the local environmental protection authority.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

According to the Environmental Impact Assessment Law of China, participation of the public should be involved in the EIA. On Jun. 2003, when preparing for the EIA, staffs from ZDWP carried out an investigation on local organizations and residents living near the Project site to collect public comments and attitudes towards the Project.

Formats

Investigation means include consultation on officers and experts, meetings, onsite survey and distribution of questionnaires.

Major issues

(1) Overall attitude toward the Project
(2) Impacts on the local environment and society of the Project
(3) Impacts on the local economy development of the Project
(4) Attitude toward the migration and the new place to be relocated
(5) Attitude toward the environmental impacts of the construction of the Project

Distribution of questionnaires

The public survey was carried out by the way of distributing 87 questionnaires with a response rate of 100%. Questionnaires were distributed according to the principle of both representation and randomness in order to reflect the public opinions and comments in a fair and real manner. Specially, 22 questionnairs were distributed in Baidixu Village to collect the comments of residents need to be relocated, which represent 22 families and constitute 24% of the total families need to be relocated.

Of all the respondents, 3.4% are under the age of 20, 19.5% between 21 and 40 and 77.1% over 41; 80.5% are male and 19.5% female; 74.7% have a highest education level of junior middle school and 25.3% senior middle school or above; 2.3% are teachers, 89.7% farmers, 2.3% workers and 5.7% others.

E.2. Summary of comments received

>>

The following is a summary of the key findings based on returned questionnaires.

- ✧ 87.4% of the respondents support the construction of the Project, 12.6% hold a neutral attitude.
- ✧ 60% of the respondents consider that the construction and operation of the Project will contribute to the local society and economy development, and 67% consider that the negative impacts on their living are insignificant.
- ✧ Most of the migrants accept the resettlement plan. They are mainly concerned about the traffic

condition and construction of the new inhabitation.

- Environmental concerns include environmental impacts during the construction period, impacts on water quality and impacts from farmland submerging.

E.3. Report on consideration of comments received

>>

After negotiating, the Project owner has signed the Migration Resettlement Agreement with residents need to be relocated and the Migration Resettlement Agreement has approved by the local government. According to the agreement, Baidixu villagers will be totally moved to upstream right bank near Qidu Village. Since the new inhabitation is located on a plain area near the county seat with convenient traffic and infrastructure as road, electric power, and communication facilities, the resettlement will ensure better household, education, health and public facilities and provide predicted development opportunities for the poverty-stricken Baidixu villagers. At present, the resettlement program has almost been finished, and the public feedbacks are positive.

The Project owner will put all of the measures listed in the EIA into effect, so as to mitigate environmental impacts arose from engineering construction. Wastewater cannot be drained unless it is disposed in advance to reach the environmental standard, thus, there has little influence on the water quality.

The Project owner has signed the compensation agreement for land occupation with local residents, and the compensation standard were set according to relevant laws, local regulations and negotiation with local residents. The compensation agreement approved by the local government is being strictly enforced by the Project owner at present.

To sum up, the local residents are very supportive on the Project. The Project owner has taken full consideration of the comments and suggestions given by stakeholders during the project implementation. The Project owner will also keep regular communication with the public regarding the construction and operation of the Project.

SECTION F. Approval and authorization

>>

The project has been registered in CDM-EB in 12/08/2009; The project has got the LOAs from the project participants’ country. More details please the website below.

http://cdm.unfccc.int/Projects/DB/DNV-CUK1218618349.9/view

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Zhejiang Longyou Xiaoxitan Hydro Complex Development Co., Ltd.
Street/P.O. Box	Xiaoxitan Village, Huzhen Town, Longyou County, Zhejiang Province
Building	-
City	Quzhou City
State/Region	Zhejiang Province
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Country	P.R.China
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Fax	+86-0570-7059555
E-mail	-
Website	-
Contact person	Xu Songbiao
Title	General Manager
Salutation	Mr.
Last name	Xu
Middle name	
First name	Songbiao
Department	-
Mobile	-
Direct fax	+86-0570-7059555
Direct tel.	+86-0570-7111673
Personal e-mail	xxtclq@163.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	China Carbon N.V.
Street/P.O. Box	Zuidplein 138
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City	Amsterdam
State/Region	-
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Country	The Netherlands
Telephone	+31-20-6753588
Fax	+31-20-6753538
E-mail	j.stankovic@chinacarbonfoud.com
Website	-
Contact person	Jelena Stankovic

Title	-
Salutation	Ms.
Last name	Stankovic
Middle name	-
First name	Jelena
Department	-
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Direct fax	+31-20-6753538
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Personal e-mail	j.stankovic@chinacarbonfoud.com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Hanergy Carbon Asset Management (Beijing) Inc.
Street/P.O. Box	No.8 Beichenxi Rd.
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State/Region	Chaoyang District
Postcode	100101
Country	China
Telephone	+86-10-83914567
Fax	+86-10-83914555
E-mail	cdm@hanergy.com
Website	-
Contact person	Wang Yingying
Title	-
Salutation	Ms.
Last name	Wang
Middle name	-
First name	Yingying
Department	-
Mobile	-
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Appendix 2. Affirmation regarding public funding

No applicable.

Appendix 3. Applicability of methodology and standardized baseline

No applicable.

Appendix 4. Further background information on ex ante calculation of emission reductions

The calculation method and data recommended in the *Notification on 2014 Baseline Emission Factors for Regional Power Grids in China*[3] for ECPG are adopted in this PDD.

Table A1~A3 show the thermal power generation supplied to ECPG in 2010, 2011 and 2012

Table A1. Thermal power generation data within ECPG in 2010

Province	**Thermal power generation**	**Auxiliary electricity consumption**	**Thermal power supplied to the grid**
	（MWh）	（%）	（MWh）
Shanghai	94,200,000	4.98	89,508,840
Jiangsu	330,500,000	5.27	313,082,650
Zhejiang	208,200,000	5.34	197,082,120
Anhui	142,600,000	5.37	134,942,380
Fujian	89,100,000	5.17	84,493,530
Total			819,109,520

Data source: China Electric Power Yearbook 2011 Edition.

Table A2. Thermal power generation data within ECPG in 2011

Province	**Thermal power generation**	**Auxiliary electricity consumption**	**Thermal power supplied to the grid**
	（MWh）	（%）	（MWh）
Shanghai	102,200,000	4.6	97,498,800
Jiangsu	373,100,000	5.1	354,071,900
Zhejiang	234,300,000	4.9	222,819,300
Anhui	162,400,000	5	154,280,000
Fujian	127,200,000	4.7	121,221,600
Total			949,891,600

Data source: China Electric Power Yearbook 2012 Edition;

Table A3. Thermal power generation data within ECPG in 2012

Province	**Thermal power generation**	**Auxiliary electricity consumption**	**Thermal power supplied to the grid**

[3] China DNA (http://cdm.ccchina.gov.cn), Sep 17th ,2007.

	（MWh)	（%）	（MWh)
Shanghai	96,700,000	4.5	92,348,500
Jiangsu	394,300,000	5.0	374,585,000
Zhejiang	227,300,000	4.9	216,162,300
Anhui	176,700,000	4.9	168,041,700
Fujian	111,800,000	4.7	106,545,400
Total			957,682,900

Data source: China Electric Power Yearbook 2013 Edition

With reference to the “2014 Baseline Emission Factors for Regional Power Grids in China”, Table A4 shows the low calorific values and emission factors that are to be used in the following OM emission factor calculation and BM emission factor calculation

Table A4. Data of fuels consumed for electricity generation

	Carbon cotent (tc/TJ)	**Oxidation factor (%)**	**Emission factor (kgCO2/TJ)**	**NCV (MJ/t,km3)**
Raw coal	25.8	100	87,300	20908
Cleaned coal	25.8	100	87,300	26344
Other washed coal	25.8	100	87,300	8363
Coal briquette	26.6	100	87,300	20908
Coke	29.2	100	95,700	28435
Coal gangue	25.8	100	87,300	8363*
Coke oven gas	12.1	100	37,300	16726*
blast furnace gas	70.8	100	219,000	3763*
Converter gas	46.9	100	145,000	7945*
Other coal gas	12.2	100	37,300	5227
Crude oil	20	100	71,100	41816
Gasoline	18.9	100	67,500	43070
Diesel	20.2	100	72,600	42652
Kerosene	19.6	100	71,900	43070
Fuel oil	21.1	100	75,500	41816
petroleum coke	26.6	100	82,900	31947*
LPG	17.2	100	61,600	50179
LNG	15.3	100	54,300	51434*
Refinery gas	15.7	100	48,200	46055
Natural gas	15.3	100	54,300	38931
Other petroleum	20	100	72,200	41816
Other coke	25.8	100	95,700	28435
Other enegy	0	0	0	0

Data sources: China Energy Statistical Yearbook 2009 Edition;

Table 1.3 and Table 1.4, Chapter 1, Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories;

Public Institution Energy Consumption Statistics System (Jul. 2011)

Table A5~A7 show the calculation of the simple OM emission factor of ECPG

Table A5. Calculation of the simple OM emission factor of ECPG in 2010

Fuel type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total	Carbon content	Oxidation factor	Emission	NCV	CO_2 emissions (tCO_2e)
								tc/TJ	%	$kgCO_2/TJ$	$MJ/t,km^3$	K=F* I *J /100000 (mass unit)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J	K=F*I*J/10000 (volume unit)
Raw coal	10^4t	3421.2	12612.92	8254.08	5230.09	3371.11	**32889.4**	25.8	100	87,300	20,908	600,319,825
Cleaned coal	10^4t						**0**	25.8	100	87,300	26,344	0
Other washed	10^4t		230.14	2.25	1301.82		**1534.21**	25.8	100	87,300	8,363	11,201,112
Coal briquette	10^4t						**0**	29.2	100	95,700	28,435	0
Coke	10^4t		20.69	1.04	236.33	34.67	**292.73**	25.8	100	87,300	8,363	2,137,192
Coal gangue	10^4t	0.67	10.8	0.26	5.28	0.19	**17.2**	12.1	100	37,300	16,726	1,073,073
Coke oven gas	10^8m^3	106.03	108.95	14.19	76.22	6.21	**311.6**	70.8	100	219,000	3,763	25,678,863
blast furnace	10^8m^3	12.19	4.31	0.95	1.09	0.46	**19**	46.9	100	145,000	7,945	2,188,848
Converter gas	10^8m^3						**0**	12.1	100	37,300	5,227	0
Other coal gas	10^8m^3			3.23			**3.23**	20	100	71,100	41,816	96,032
Crude oil	10^4t						**0**	18.9	100	67,500	43,070	0
Gasoline	10^4t	0.9	1.98	1.04		3.19	**7.11**	20.2	100	72,600	42,652	220,164
Diesel	10^4t	17.53	0.06	5.14		0.73	**23.46**	21.1	100	75,500	41,816	740,658
Fuel oil	10^4t						**0**	20.2	100	72,600	43,096	0
Naphtha	10^4t						**0**	20	100	71,900	41,398	0
Lubricant oil	10^4t						**0**	20	100	72,200	39,934	0
Paraffin	10^4t						**0**	20	100	72,200	42,945	0
petroleum	10^4t						**0**	21	100	69,300	38,931	0
petroleum coke	10^4t	23.49		37.5			**60.99**	26.6	100	82,900	31,947	1,615,263
LPG	10^4t						**0**	15.3	100	54,300	51,434	0
Refinery gas	10^4t	0.76	0.16		1.18	42.17	**44.27**	15.7	100	48,200	46,055	982,728
LNG	10^4t			2.76			**2.76**	15.3	100	54,300	51,434	77,083
Natural gas	10^8m^3	7.47	24.39	17.53		19.09	**68.48**	15.3	100	54,300	38,931	14,476,352
Other petroleum	10^4t	0.05	1.22				**1.27**	20	100	72,200	41,816	38,343
Other coke products	10^4t						**0**	25.8	100	95,700	28,435	0
Other energy	10^4t	15.59	112.68	49.33	28.77	1.1	**207.47**	0	0	0	0	0

Total	660,845,535
Power delivered (MWh)	16,547,520
Average emission factor of China Central Power Grid (tCO_2e/MWh)	1.0333
Power delivered from CCPG(MWh)	40113670
CCPG simple OM	0.9923
Total emission of ECPG (tCO_2)	717,748,199
Thermal power supplied to ECPG (MWh)	875,770,710
Simple OM emission factor of ECPG (tCO_2e/MWh)	0.8196

Table A6. Calculation of the simple OM emission factor of ECPG in 2011

Fuel type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total	Carbon	Oxidation factor	Emission	NCV	CO_2 emissions (tCO_2e)
								tc/TJ	%	$kgCO_2$/TJ	MJ/t,km^3	K=F*J*I/100000 (mass unit)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J	J=E*H*I/10000 (volume unit)
Raw coal	10^4t	3667.6	15074.2	9033.56	5690.2	5160	**38625.59**	25.8	100	87,300	20,908	705,020,689
Washed coal	10^4t						**0**	25.8	100	87,300	26,344	0
Other washed	10^4t		192.29		1555.0		**1747.32**	25.8	100	87,300	8,363	12,757,007
Coke	10^4t						**0**	29.2	100	95,700	28,435	0
Coal gangue	10^4t		186.46	1	185.19		**372.65**	25.8	100	87,300	8,363	2,720,680
Coke oven	10^8m	0.77	10.49	0.34	5.73	0.19	**17.52**	12.1	100	37,300	16,726	1,093,037
Blast furnace	10^8m			25.32		7.29	**32.61**	70.8	100	219,000	3,763	2,687,380
Converter gas	10^8m			1.16		0.44	**1.6**	46.9	100	145,000	7,945	184,324
Other gas	10^8m	32.18					**32.18**	12.1	100	37,300	5,227	627,404
Crude oil	10^4t			2.03			**2.03**	20	100	71,100	41,816	60,354
Gasoline	10^4t						**0**	18.9	100	67,500	43,070	0
Diesel	10^4t	0.87	2.2	1.01	0.31	1.28	**5.67**	20.2	100	72,600	42,652	175,574
Fuel oil	10^4t	14.15	0.2	7.05		0.44	**21.84**	21.1	100	75,500	41,816	689,512
Naphtha	10^4t						**0**	20.2	100	72,600	43,096	0
Lubricating oil	10^4t						**0**	20	100	71,900	41,398	0
Paraffin	10^4t						**0**	20	100	72,200	39,934	0
Miscella	10^4t						**0**	20	100	72,200	42,945	0
Petroleum	10^4t						**0**	21	100	69,300	38,931	0
Petroleum	10^4t	21.22	1.29	40.77			**63.28**	26.6	100	82,900	31,947	1,675,912

LNG	10^4t			1.65			**1.65**	15.3	100	54,300	51,434	46,082
LPG	10^4t						**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.46	0.21		1.2	41.55	**43.42**	15.7	100	48,200	46,055	963,859
Natural gas	10^8m^3	10.24	35.96	25.49		22.39	**94.08**	15.3	100	54,300	38,931	19,888,073
Other petroleum	10^4t	0.05	1.14				**1.19**	20	100	72,200	41,816	35,927
Other coking products	10^4t						**0**	25.8	100	95,700	28,435	0
Other energy	10^4t	16.34	122.66	74.06	213.74	1.28	**428.08**	0	0	0	0	0
											Total	748,625,815
	Power delivered (MWh)											15,769,540
	Average emission factor of China Central Power Grid (tCO_2e/MWh)											1.0798
	Power delivered from CCPG(MWh)											33792550
	CCPG simple OM											0.9827
	Total emission of ECPG (tCO_2)											798,860,382
	Thermal power supplied to ECPG (MWh)											999,453,690
	Simple OM emission factor of ECPG (tCO_2e/MWh)											0.7993

Data sources: China Energy Statistical Yearbook 2012 Edition

Table A7. Calculation of the simple OM emission factor of ECPG in 2012

Fuel type	**Unit**	**Shanghai**	**Jiangsu**	**Zhejiang**	**Anhui**	**Fujian**	**Total**	**Carbon**	**Oxidation**	**Emission**	**NCV**	**CO_2 emissions (tCO_2e)**
								tc/TJ	**%**	**$kgCO_2$/TJ**	**MJ/t,km³**	**K=F*J*I/100000 (mass unit)**
		A	**B**	**C**	**D**	**E**	**F=A+B+C+D+E**	**G**	**H**	**I**	**J**	**J=E*H*I/10000 (volume unit)**
Raw coal	10^4t	3397.31	15723.	8633.7	7539	4501.	**39796.56**	25.8	100	87,300	20,908	726,394,034
Washed coal	10^4t						**0**	25.8	100	87,300	26,344	0
Other washed coal	10^4t		242.09		298.		**540.83**	25.8	100	87,300	8,363	3,948,545
Briquette	10^4t						**0**	26.6	100	87,300	20,908	0
Gangue	10^4t		22.08	0.8	297.		**319.96**	25.8	100	87,300	8,363	2,335,996

Coke	10^4t						**0**	29.2	100	95,700	28,435	0
Coke oven gas	10^8m^3	1.18	10.38	0.69	5.56	0.28	**18.09**	12.1	100	37,300	16,726	1,128,599
Blast furnace gas	10^8m^3			33.19	18.2	9.67	**61.1**	70.8	100	219,000	3,763	5,035,233
Converter gas	10^8m^3			1.52	3.47	1.11	**6.1**	46.9	100	145,000	7,945	702,735
Other gas	10^8m^3	25.7					**25.7**	12.1	100	37,300	5,227	501,065
Other coke	10^4t						**0**	25.8	100	95,700	28,435	0
Crude oil	10^4t			2.25			**2.25**	20	100	71,100	41,816	66,895
Gasoline	10^4t						**0**	18.9	100	67,500	43,070	0
Kerosene	10^4t						**0**	19.6	100	71,900	43,070	0
Diesel	10^4t	0.75	1.7	0.86	0.41	1.02	**4.74**	20.2	100	72,600	42,652	146,776
Fuel oil	10^4t	7.58	0.19	1.29		0.62	**9.68**	21.1	100	75,500	41,816	305,608
Naphtha	10^4t						**0**	20.2	100	72,600	43,906	0
Lubricant oil	10^4t						**0**	20	100	71,900	41,398	0
Olefin	10^4t						**0**	20	100	72,200	39,934	0
Mineral spirits	10^4t						**0**	20	100	72,200	42,915	0
Petroleum asphalt	10^4t						**0**	21	100	69,300	38,931	0
Petroleum coke	10^4t	17.84	0.27	36.15			**54.26**	26.6	100	82,900	31,947	1,437,025
LPG	10^4t						**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.44	0.44		0.99	42.02	**43.89**	15.7	100	48,200	46,055	974,293
Other petroleum	10^4t	0.02	1.11				**1.13**	20	100	72,200	41,816	34,116
Natural gas	10^8m^3	14.54	43.95	25.31		21.41	**105.21**	15.3	100	54,300	38,931	22,240,903
LNG	10^4t			0.03			**0.03**	15.3	100	54,300	51,434	838
Other energy	10^4t	18.97	185.57	60.95	210.	0.67	**476.74**	0	0	0	0	0
											Total	765,252,660
	Power delivered (MWh)											16,980,330
	Average emission factor of China Central Power Grid (tCO_2e/MWh)											1.05830
	Power delivered from CCPG(MWh)											52,287,240
	CCPG simple OM											0.9437
	Total emission of ECPG (tCO_2)											832,563,265
	Thermal power supplied to ECPG (MWh)											1,026,950,470
	Simple OM emission factor of ECPG (tCO_2e/MWh)											0.8107

Data sources: China Energy Statistical Yearbook 2013 Edition

The simple OM emission factor is weighted average value of the simple OM emission factors of ECPG in 2010, 2011 and 2012 as follows:

$EF_{OM,y}$=0.8095tCO_2e/MWh

Table A8 is data of the efficiency level of the best electricity generation technologies commercially available in China and the corresponding emission factors with reference to the *2013 Baseline Emission Factors for Regional Power Grids in China* issued by Chinese DNA.

Table A8. The data of efficiency level of the best electricity generation technologies commercially available in China and the corresponding emission factors

	Parameter	**Efficiency of supplying electricity (%)**	**Fuel emission factor (tCO_2/TJ)**	**Oxidation factor**	**Emission factor (tCO_2e/MWh)**
		A	B	C	D=3.6/A/10,000*B*C
Coal-fired power plant	$EF_{Coal,Adv,y}$	40.03	87,300	1	0.7851
Oil-fired power plant	$EF_{Oil,Adv,y}$	52.9	75,500	1	0.5138
Gas-fired power plant	$EF_{Gas,Adv,u}$	52.9	54,300	1	0.3695

Table A9. Data for calculating the thermal power emission factors

Fuel type	Unit	Shanghai A	Jiangsu B	Zhejiang C	Anhui D	Fujian E	Total F=A+…+E	NCV (MJ/t, km^3) G	Emission factor (tc/TJ) H	Oxidation factor I	Emission (tCO_2e) J=F*H*I*G/100,000
Raw coal	10^4t	3,397.31	15,723.65	8,633.73	7,539.89	4,501.98	39,796.56	20,908	87,300	1	726,394,034
Cleaned coal	10^4t	0	0	0	0	0	0.00	26,344	87,300	1	0
Other washed coal	10^4t	0	242.09		298.74	0	540.83	8,363	87,300	1	3,948,545
Coal briquette	10^4t	0	0	0	0	0	0.00	20,908	87,300	1	0
Coal gangue	10^4t	0	22.08	0.8	297.08	0	319.96	8,363	87,300	1	2,335,996
Coke	10^4t	0	0	0	0	0	0.00	28,435	95,700	1	0
Other coke products	10^4t	0	0	0	0	0	0.00	28,435	95,700	1	0
Sub-total											**732,678,575**
Crude oil	10^4t	0	0	2.25	0	0	2.25	41,816	71,100	1	66,895
Gasoline	10^4t	0	0	0	0	0	0.00	43,070	67,500	1	0
Kerosene		0	0	0	0	0	0.00	43,070	71,900	1	0
Diesel	10^4t	0.75	1.7	0.86	0.41	1.02	4.74	42,652	72,600	1	146,776
Fuel oil	10^4t	7.58	0.19	1.29	0	0.62	9.68	41,816	75,500	1	305,608
Petroleum coke	10^4t	17.84	0.27	36.15	0	0	54.26	31,947	82,900	1	1,437,025
Other oil products	10^4t	0.02	1.11	0	0	0	1.13	41,816	72,200	1	34,116
Sub-total											**1,990,420**
Natural gas	10^7m^3	145.4	439.5	253.1	0	214.1	1,052.10	38,931	54,300	1	22,240,903
LNG	10^4t	0	0	0.03	0	0	0.03	51,434	54,300	1	838
Coke oven gas	10^7m^3	11 .80	103.8	6.9	55.6	2.8	180.90	16,726	37,300	1	1,128,599
Blast furnace gas	10^7m^3	0	0	331.9	182.4	96.7	611.00	3,763	219,000	1	5,035,233
Converter gas	10^7m^3	0	0	15.2	34.7	11 .10	61.00	7,945	145,000	1	702,735
Other coal gas	10^7m^3	257	0	0	0	0	257.00	5,227	37,300	1	501,065
LPG	10^4t	0	0	0	0	0	0.00	50,179	61,600	1	0
Refinery gas	10^4t	0.44	0.44	0	0.99	42.02	43.89	46,055	48,200	1	974,293
Sub-total											**30,583,665**
Other energy	10^4t Ce	18.97	185.57	60.95	210.58	0.67	476.74	0	0	0	0
Total											**765,252,660**

Data sources: China Energy Statistical Yearbook 2013

Calculate with data provided in Table A8, A9, $\lambda_{Coal,y}$ =95.74%，$\lambda_{Oil,y}$ =0.26%，$\lambda_{Gas,y}$ =4.00%。

Then $EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$ = 0.76780 tCO_2e/MWh

Table A10. Installed capacity of ECPG in 2012

	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal power (MW)	21,180	69,820	47,050	32,230	26,320	196,600
Hydro power (MW)	0	1,140	9,840	2,780	11,400	25,160
Nuclear power (MW)		2,120	4,330	0		6,450
Wind power and Other (MW)	285	2,360	412	319	1,131	4,507
Total (MW)	21,465	75,440	61,632	35,329	38,851	232,717

Data source: China Electric Power Yearbook 2013

Table A11. Installed capacity of ECPG in 2011

	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal power (MW)	19,430	64,800	46,260	29,590	25,100	185,180
Hydro power (MW)	0	1,140	9,710	2,000	11,250	24,100
Nuclear power (MW)	0	2120	4,330	0	0	6,450
Wind power and Other (MW)	224	1,976	328	204	820	3,552
Total (MW)	19,654	70,036	60,628	31,794	37,170	219,282

Data source: China Electric Power Yearbook 2012

Table A12. Installed capacity of ECPG in 2010

	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal power (MW)	18,430	59,980	43,600	27,630	23,070	172,710
Hydro power (MW)	0	1,140	9,690	1,690	11,110	23,630
Nuclear power (MW)	0	2,120	3,670	0	0	5,790
Wind power and Other (MW)	154	1,460	257	0	550	2,421
Total (MW)	18,584	64,700	57,217	29,320	34,730	204,551

Data source: China Electric Power Yearbook 2011

Table A13. Installed capacity of ECPG in 2009

	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal power (MW)	16,540	52,420	43,300	26,790	18,920	157,970
Hydro power (MW)	0	1,140	9,560	1,620	10,980	23,300
Nuclear power (MW)	0	2,120	3,010	0	0	5,130
Wind power and Other (MW)	42.1	952.5	233.9	0	460	1,689
Total (MW)	16,582	56,633	56,104	28,410	30,360	188,089

Data source: China Electric Power Yearbook 2010

Table A14. Calculation of BM emission factor of ECPG

	Installed capacity in 2009	Installed capacity in 2010	Installed capacity in 2011	Installed capacity in 2012	Capacity additions from 2009-2012[1]	Capacity additions from 2010-2012[2]	Capacity additions from 2010-2012[2]	Share in total capacity additions 2009-2012
MW	**A**	**B**	**C**	**D**	E	**F**	**G**	**H**
Thermal power (MW)	157,970	172,710	185,180	196,600	48,292	27,732	11,420	89.36%
Hydro power (MW)	23,300	23,630	24,100	25,160	1,610	1,280	1,060	2.98%
Nuclear power (MW)	5,130	5,790	6,450	6,450	1,320	660	0	2.44%
Wind power and Others (MW)	1,689	2,421	3,552	4,507	2,818	2,086	955	5.21%
Total (MW)	**188,089**	**204,551**	**219,282**	**232,717**	**54,040**	**31,758**	**13,435**	**100.00%**
Proportion to the installed capacity in 2012					23.22%	13.65%	5.77%	

Note 1, Note 2 and Note 3 is the calculated new added capacity considering capacity, shutting down unit capacity and pumped storage capacity.

Based on Table A14, calculate the BM emission factor of ECPG as:

$EF_{BM,y}$=0.76780×89.36%=0.6861tCO_2/MWh

Appendix 5. Further background information on monitoring plan

No applicable.

Appendix 6. Summary of post registration changes

No applicable.

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Document information

Version	*Date*	*Description*
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
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